Vol. XLI, No. 8 Concrete August, 1933

Urges Different Types of Cement for Special Service Conditions

Present A. S. T. M. Specifications Declared Inadequate—One Cement Can Not Serve All Purposes—Distinctive Properties Needed in Each Type

TODAY portland cement is employed in a variety of uses and conditions of service that were hardly thought of when it first appeared on the market. In 1900, concrete highways and reinforced concrete buildings were curiosities. More concrete was used in large masses such as fair-sized dams, and even at that period there was considerable discussion regarding the heat evolved in such structures by the hydration of the cement. Lime mortars were still almost exclusively used for setting masonry, and such materials as plant-made products—block, tile, pipe—were but little advanced. Now cement has found its way into many unexpected places and has been under observation for such periods that excellent estimates of true success are available.

No All-Purpose Cement

Today, also, many engineers have learned enough about cement, especially of certain physical characteristics, to know that any one type of hydraulic cement will not fulfill all the demands which the great variety of service conditions present.

Let us consider some of the outstanding conditions which concrete must meet in its many modern applications. Possibly the first adverse condition noted was that of aggressive salt solutions, especially sulphates in sea water, mine water, and the white alkali of our West. Several answers to this problem have been offered so far as the cement itself is concerned—cements of high iron content as contrasted to high alumina content, the so-called fused cements or lime aluminate cements as contrasted to the lime silicate cements, portland cements admixed with active siliceous materials, such as the many varieties of natural puzzolana and blast-furnace slag, and lastly the proper and careful use of the usual portland cement of commerce. But none of these answers is acceptable to more than a few. There are very active proponents of each and just as active opponents.

Retaining walls, conduits, tunnel linings, etc., present a problem through the solvent action of percolating water of even a potable purity. High-limed cements such as portland, before or after setting, are decidedly soluble in water. If it were not so, setting would not result. The result of the action of water is the rapid saturation of the latter with the production of less basic compounds which are less readily acted upon by the water. If water can not percolate due to the denseness of the concrete or other means, the continued solution will be prevented. The necessity of preventing percolating waters has been generally recognized, but the waterproofing of concrete or the using of less basic cements is a topic which always arouses discussion, and which in turn seems to change the preconceived ideas of but a few.

Cycles of heat and cold, wetting and drying, freezing and thawing, constitute what may be called weather conditions. Set portland cement has a fairly high coefficient of thermal dilation—how much it varies with different types of cement is not known with any assurance. The coefficient of dilation due to wetting and drying is even greater than that of thermal dilation, but how much it varies with different types of cement is also not satisfactorily known. Attention should be directed also to the fact that much of these same data for aggregates are not available. It is possible that aggregates of large coefficients of dilation are being used with cement of low coefficients, and vice versa. This difference doubtless would be more unfortunate than if both had high coefficients.

Service Requirements Stated

Having before us some of the outstanding uses to which cement may be placed and the outstanding conditions which it may have to meet, does it seem probable that any one type can always meet the demands? To be most effective in highway construction, it is not necessary that the heat of hydration be particularly low or that marked plasticity be present, or that the cement should be especially resistant to aggressive waters. For such use, good strength is desirable and the earlier this is obtained the better, but the cement should also be resistant to changes produced by both heat and moisture. In reinforced concrete building construction, the earlier and the higher the strength the better. But since in most cases such structures are entirely protected from the weather, the effect of almost all of the

Condensed from paper presented at the annual meeting of the American Society for Testing Materials, June 30, 1933, by P. H. Bates, chief of the clay and silica products division, U. S. Bureau of Standards, and chairman of Committee C-1 of the A. S. T. M.

other unfavorable conditions can be disregarded. The setting of masonry demands above all else a cement which will produce a very plastic mortar, but the mortar must have volume constancy both before and after hardening. Mass concrete demands a cement of low heat of hardening, seldom any very marked high strength and generally a good resistance to atmospheric changes, and in some special cases an excellent resistance to aggressive salt solutions. Other demands on the properties of cement by the conditions of its many uses could be amplified considerably, but the above will suffice to illustrate the situation.

Types of Cement Available

It would be proper next to give some thought to the type of hydraulic cements available, not only those actually on the market in the United States, but those which world use shows could be made available in domestic markets. Historically, the first to demand attention would be the puzzolanic cements—those natural and artificial materials which in a fine state of subdivision and sometimes with the addition of accelerating agents have the property of acquiring strength. In certain cases these raw materials require some slight burning to bring out the cementitious properties. In other cases the burning must be quite severe and the class of natural cements and hydraulic limes is reached. Then comes the portland cement group produced by fine grinding of clinkered pre-ground materials. Lastly, there is the group wherein the combination of oxides in the raw materials is such that fusion takes place at a relatively lower temperature than that required for making portland cement. This group includes the fused or high-alumina cements. There are available also various hybrid groups—mixtures of any two or more of those cited.

Demand Must Be Recognized

The growing tendency on the part of users to prepare specifications, covering rather restricted uses, differing from those of the A. S. T. M. in spite of revisions, indicates conclusively that the consuming public is not satisfied with matters as they have been progressing. It seems very necessary for Committee C-1 of the A. S. T. M. to give more cognizance to the existing conditions, to recognize the need of several cements for the many different uses to which cement is put, and to acknowledge the inadequacy of some of our test methods. Specifically, it must recognize the difference between the conditions prevailing in constructing a dam, a road, or a reinforced concrete building, and in the conditions in the life of these. Since these conditions are so different, it must accept the fact that we will need cements that are able to harden with minimum heats of hydration, that do not have large coefficients of thermal or moisture dilation, that are resistant to attack of aggressive waters, that do resist freezing and thawing, that for some uses have very high strength, and that for other uses have marked plasticity.

Distinctive Properties of Each Type

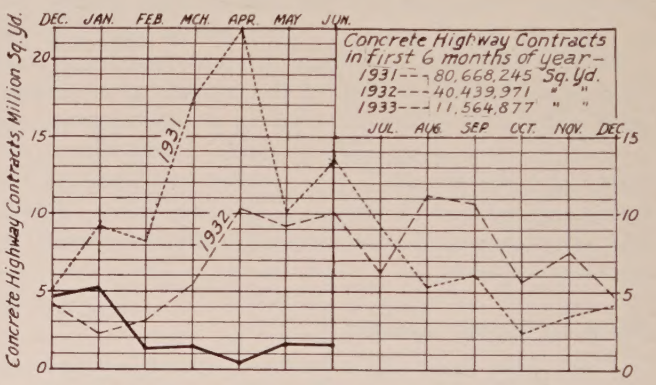
Since it seems impossible to have more than one or two of these properties developed to any major degree in any one cement, it follows that there should be prepared recognized specifications for at least six cements, namely, high-early-strength cements, plastic cements, those of low heat of hardening, those having low volume changes, those offering resistance to moisture and aggressive solutions, and at least two of somewhat the nature of our present standard portland cements, one of these two being lower in lime and higher in silica than the other.

The test methods which need most attention are more detailed chemical requirements, either no measure of fineness or one that indicates decidedly more than does the sieving test, a measure of thermal and hardening dilation, and a thorough upheaval in the strength requirements, entirely eliminating the use of the briquette of standard sand and standard consistency, and substituting therefor if we are not bold enough to use a concrete test, a cube for compression testing made of graded sand and of plastic consistency.

Highway Contracts Continue at Low Figure in June

Contracts for concrete road construction awarded in June continued in low volume, according to data compiled by the Portland Cement Association.

While practically all state highway departments are preparing to utilize their share of the amount provided



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for highway improvement in the federal public works program, none of this work had reached the contract stage at the end of June.

The month of July should begin to show the effect of that program.

✦ PERSONALS ✦

Frank T. Sheets, former chief highway engineer for Illinois, has been appointed consulting engineer of the Portland Cement Association. He had been with the state highway department since 1907.

J. W. Lewis has been appointed a field representative by the Portland Cement Association, working in the interest of home modernization out of the Chicago office.

Mr. Lewis was until recently connected with the American Marbelite Corp., prior to which he had been with the Association.

Champaign County Relief Committee Creates Useful Work

Seventeen Washed-Out Highway Bridges Rebuilt —Much Concrete Used — County Sets Example with 107 Relief Projects

By J. E. FOSTER
Illinois Emergency Relief Commission, Chicago, Ill.

IN Champaign County, Illinois, a work-relief program has been developed that is not only enabling unemployed men to earn their relief, but is also furnishing a market for structural materials.

As agent of the Illinois Emergency Relief Commission, the Champaign County Emergency Relief Committee has adopted the policy of using the funds under its control to pay men selected from relief lists for the work they do on public and civic projects.

Outline of Relief-Work Plans

These projects must be for public corporations or for civic organizations that are not operated for profit. They must not be provided for by existing budgets. All materials used in them must be paid for by the organization for which the work is done. These provisions were established by the Illinois Emergency Relief Commission, and are enforced by the Champaign County committee.

As the program was designed to enable needy persons to earn their relief, projects have been selected as far as possible with some consideration of the abilities of these people. The bulk of the people on relief rolls in Champaign County may be classed as unskilled laborers. There are, however, many building tradesmen on relief lists there. Because of the predominance of these two groups on local relief rolls, the committe has approved a large number of projects which call for unskilled workers and building tradesmen.

The result is that a local market has been created for structural materials. "An analysis of 107 work-relief projects that have been started in Champaign County shows that 65 of them involve the use of structural materials," said Francis T. Carson, chairman of the Champaign County Emergency Relief Committee. "Were it not for this program, none of the materials would have been purchased, because none of the projects to which men are assigned were provided for in current budgets."

In many of these projects concrete is used. In some it is practically the only structural material employed. In others, its use is incidental.

Projects Include Seventeen Bridges

While no attempt has been made to ascertain the total volume of materials put into use through this program, the following details on individual projects give some idea as to how work relief in Champaign County has affected the use of concrete.

A concrete sidewalk was built around the County Court House. The county laid out the grades for the walk, and the work was done by men selected from relief lists. This work required the use of 131 cu. yd. of concrete.

In the city of Champaign, a city garage is being erected to house the trucks and other vehicles used by the department of streets. This job will require 528 bbl. of cement, 290 cu. yd. of crushed stone, and 140 cu. yd. of torpedo sand, as well as other structural materials.

During the heavy rains in central Illinois this spring, seventeen bridges on county and township highways were

Building concrete abutments for 17 washed-out highway bridges constitutes part of Champaign County's relief work on useful projects

washed out. A work-relief project was approved for assigning men to building new abutments for these bridges. The county engineer estimates that this project will require the use of 942 tons of sand, 1,595 tons of gravel, and 2,175 bbl. of cement.

A general modernization program was started by the First Presbyterian Church of Champaign, which will require the use of 350 cu. yd. of gravel, 200 cu. yd. of sand, and 600 bbl. of cement.

Further evidence of the effect of this program on the use of concrete is furnished by the Nelsen Concrete Culvert Company, which operates a plant in the city of Champaign. This firm has furnished the following materials for use on projects in which work-relief labor was used:

2730 lin. ft.—54-in. reinforced concrete pipe
2650 lin. ft.— 6-in. drain tile
2360 lin. ft.—30-in. reinforced concrete pipe
2100 lin. ft.—21-in. drain tile
1224 lin. ft.—12-in. sewer pipe
1904 lin. ft.—15-in. sewer pipe
648 lin. ft.—18-in. sewer pipe

Raise Strength Requirements for Grade B Concrete Brick

Revised A. S. T. M. Specifications Approved for Publication as Tentative Standard—Copies Available in Printed Form

FOR the second time since the first issue was published in 1924 the American Society for Testing Materials has revised its specifications covering concrete brick. The latest revision, recently approved for publication as a tentative standard under the serial designation of C55-33T, increases the former strength requirements for Grade B brick from 2,250 to 2,500 lb. per sq. in., while the minimum requirement for this grade is raised from 1,500 to 2,000 lb. per sq. in. The specifications are here given in full.

(Beginning of Specifications)

Scope

1. These specifications cover concrete building brick intended for use in brick masonry.

Manufacture

2. Concrete building brick shall be manufactured from a mixture of portland cement and suitable aggregates, such as sand, gravel, crushed stone, bituminous or anthracite cinders, burned clay or shale, or blast-furnace slag.

Physical Properties and Tests

3. (*a*) Concrete building brick shall be classified as Grades B and C on the basis of the following requirements. The classification of any lot of bricks shall be determined by the results of the tests for that requirement in which it is lowest, unless otherwise specified as provided in Section 8.

	Compressive Strength (Brick Flatwise), Lb. per Sq. In., Mean Gross Area		Modulus of Rupture (Brick Flatwise), Lb. per Sq. In.	
Classification	Mean of 5 Tests	Individual Minimum	Mean of 5 Tests	Individual Minimum
Grade B	2,500 or over	2,000	450 or over	300
Grade C	1,250 to 2,500	1,000	300 to 450	200

NOTE.—The above classifications are based on strength and do not necessarily measure weathering resistance.

(*b*) The compressive strength and modulus of rupture tests shall be made in accordance with the Standard Methods of Testing Brick (Compression, Flexure, Absorption) (A.S.T.M. Designation: C 67) of the American Society for Testing Materials.[1]

Test Specimens

4. (*a*) For the purpose of tests, bricks representative of the commercial product shall be selected by a competent person appointed by the purchaser, the place or places of selection to be designated when the purchase order is placed. The manufacturer or seller shall furnish specimens for tests without charge. All bricks shall be carefully examined, and their condition noted before testing. For the purpose of tests, not less than ten bricks shall be required for each investigation. In general, two samples of ten bricks each shall be tested for every 100,000 bricks contained in the lot under consideration; but where the total quantity exceeds 500,000 bricks, one sample of ten bricks from each 100,000 bricks shall be tested. Additional representative samples may be taken at any time or place at the discretion of the purchaser.

(*b*) Concrete building brick when tested shall be at least 28 days old, unless otherwise mutually agreed upon between the manufacturer and the purchaser. Representative samples from brick delivered on the job may be tested at any time by the purchaser.

Size

5. Concrete building brick shall be 2¼ by 3¾ by 8 in., with a permissible variation of ± 1/16 in. in depth, ± ⅛ in. in width and ± ¼ in. in length.

Workmanship and Finish

6. When any particular surface appearance or uniformity is desired, it shall be mutually agreed upon between the manufacturer and the purchaser.

Inspection and Rejection

7. Brick shall pass a visual inspection for freedom from cracks and irregularity. Cracked or misshaped brick shall be rejected.

Acceptance

8. At the option of the purchaser, acceptance may be based on the visual inspection requirements specified in Section 7 and on the results of one of the strength tests (compression or flexure) specified in Section 3.

(End of Specifications)

Copies of the revised specification may be obtained in printed form at 25 cents each, from the secretary of the A.S.T.M. For larger quantities a special price will be quoted.

[1] 1931 Supplement to Book of A.S.T.M. Standards, p. 65.

From the Patent Office

By J. KAPLAN
Patent Attorney, Washington, D. C.

DAM—No. 1,907,998. Fred A. Noetzli, of Los Angeles County, Calif. Patented May 9, 1933.

Fred A. Noetzli of Los Angeles County, Calif., has recently invented a dam of the straight gravity or curved type which will, he claims, be less expensive to build and safer than similar dams heretofore constructed. One of the objects of the invention is to

provide a construction which will employ long expanses of concrete wherein joints are established at intervals to permit shrinkage and temperature changes without weakening of the dam.

Another object of the invention is to provide a novel construction for concrete dams with joints, by widening the joints temporarily by forcing water under pressure into certain sections of the area of a joint, thus widening it by a small amount, and then forcing cement grout into certain other sections of the area of the widened joint. Subsequently, the area of the joint is filled completely with cement grout.

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HYDRAULIC CEMENT—No. 1,907,003. Edward W. Rice of Santa Cruz, California, Assignor to Santa Cruz Portland Cement Co., of San Francisco, California. Patented May 2, 1933.

The preferred proportions and method of making the cement are as follows:

To 70 per cent by weight of well burned portland cement clinker is added about 24 per cent of shale and about 6 per cent of quicklime and the usual small amount of gypsum for the clinker content to control the set. The proportions will vary somewhat with the nature of the siliceous material used and are worked out for a Monterey shale running about 75 per cent silica. Various clays may be used as well as shale.

The clinker, shale, lime and gypsum are all ground together in a cement mill to an extremely fine condition, preferably so that about 95 per cent will pass a 200-mesh sieve.

The resulting powder is a cement which may be used in the manner of regular portland cement by gauging with water, but in actual tests against average portland cement, both in neat form as well as in concrete, it shows a marked increase in early strength as well as at the end of the 28-day period covered by the tests.

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CONCRETE JOINT—No. 1,903,456. John N. Heltzel, of Warren, Ohio. Patented April 11, 1933.

This invention relates to concrete joints, as in concrete roads and other surfacing structures, and it is the object of this invention to provide novel and improved means for controlling the breaks and defining the joints of the road or other cementitious structure.

In installing the invention in the building of a concrete road, a longitudinal strip is embedded in the plastic concrete, preferably along the longitudinal center line of the road, for defining the longitudinal break or joint. Transverse strips may also be embedded in the concrete to define the transverse breaks or joints, and the strips divide the road into slabs or sections in order to take care of the expansion and contraction of the concrete without the concrete spalling or crumbling along the breaks or joints. The strips extend from the sub-base to the surface of the concrete and are composed of wire screen, fabric, perforated paper or other material which is also flexible.

To Engage Architects and Engineers in Public Works Program

Private architects and engineers throughout the country will be engaged by the U. S. Treasury Department to prepare the plans and specifications for the large federal building program, which may reach a total of $200,000,000. L. W. Robert, Jr., Assistant Secretary of the Treasury, has adopted this policy in order that professional men may benefit by the large expenditure for new federal buildings, the design and construction of which come under the authority of the Supervising Architect, Treasury Department.

For the purpose of spreading employment as far as possible among architects and engineers, Mr. Robert has requested the assistance of the American Institute of Architects and the American Engineering Council in the enrollment of qualified firms and individuals. His purpose is to engage, on every building, engineers and architects who are residents of the state in which the building is to be erected.

Any qualified engineer desiring to participate in this work should send to L. W. Wallace, executive secretary, American Engineering Council, 744 Jackson Place, N. W., Washington, D. C., a complete statement, in duplicate, of his professional record, with a citation of significant references.

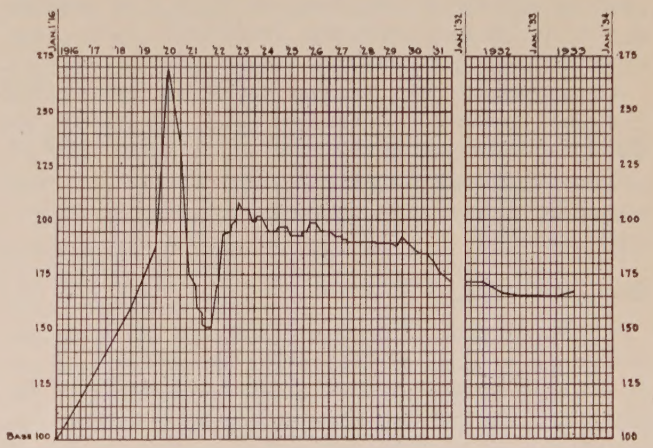
Architects who have not already received a pre-qualification blank from the Treasury Department should request duplicate blanks from Assistant Secretary Robert.

Illinois Decision Against Diversion of Gasoline Tax

The leading editorial in the July issue of CONCRETE told of the permanent injunction against the diversion of gasoline tax funds, granted to the Illinois Construction Council by Judge L. E. Stone, of the Sangamon County (Springfield) circuit court.

Copies of the decree granting the injunction, and a digest of other court decisions which form the background for the decree, may be obtained from the Portland Cement Association, 33 W. Grand Ave., Chicago.

Aberthaw Index of Cost of Building



The first upturn in construction cost since the close of 1929 is shown in the Aberthaw Index of cost of building construction, computed for July 1. The index figure has risen 2½ points, to 167½, indicating a cost of $1.77 per sq. ft. of floor area for the 7-story reinforced concrete industrial building used as the basis of the estimate.

This advance is ascribed mainly to higher prices for building materials.

Vast Construction Project in Northwest Exposition

Plans for a great building and engineering construction project on the Pacific Coast are reported nearing completion with the perfecting of the organization for the Great Pacific Northwest Exposition for 1936 at Seattle, Washington.

Under the plans of the exposition the corporation will obtain a tract of land, clear, grade and beautify it, construct permanent buildings, the main one to cost in the neighborhood of $20,000,000, and give to the Pacific Northwest a world fair.

Plans are being perfected at the World Fair Headquarters at 106 Securities Bldg., Seattle.

Vibration and Delayed Finishing Improve Pavement Concrete

Tests of Full-Size Pavements by U. S. Bureau of Public Roads Reported by Jackson and Kellermann—Methods and Results

TESTS conducted recently by the U. S. Bureau of Public Roads on a number of full-size concrete pavement sections, placed and finished under actual working conditions, have demonstrated the value of high-frequency vibration in placing concrete pavements. The general procedure was similar to that outlined in the report of an earlier series presented before the A. S. T. M. in 1931.[1]

In the earlier tests it was determined quite definitely that pavement concrete having a slump less than 2 in. could not be placed satisfactorily by the prevailing methods of finishing.

In general the more recent tests indicate that by using vibratory equipment of the type employed it should be possible satisfactorily to place and finish drier concrete as well as concrete containing considerably more coarse aggregate than by the methods now in common use.

The indications also are that the use of the so-called "Johnson method" of delayed finishing will increase the density and strength of the concrete pavement slabs by eliminating a larger quantity of excess water before final consolidation than is accomplished by the methods generally employed.

Nature of Tests

For the purpose of discussion, the two series of tests are treated separately. The results obtained by the use of vibrators comprise series A, and the discussion of the tests which involved the principle of delayed finishing for the purpose of removing excess water, otherwise known as the "Johnson method," comprise series B. The same general types of crushed limestone, gravel and blast-furnace slag were used as coarse aggregate.

SERIES A—TESTS TO DETERMINE EFFECT OF VIBRATION

For series A a standard double screed finishing machine was equipped with three high-frequency vibrators, two mounted on the front screed and one on the rear screed. Each vibrator consisted of a 1/3-hp. electric motor operating at an approximate speed of 3,600 r.p.m. There was attached to the rotor of each motor an eccentric weight which, revolving at high speed, imparted a vibratory motion to the screed. The motors were operated with current supplied from a gasoline-electric generator unit mounted on the finishing machine.

The only modification of the finishing machine as ordinarily used, other than the installation of the vibrators, was the use of a "bull nose" strike-off, which was riveted to the front screed. This device was furnished and recommended by the manufacturer of the finishing machine on the theory that the rounded surface of the "bull nose" would tend to consolidate as well as strike off the surface of the concrete.

In general, the finishing machine was operated at about the same forward speed as is customarily used. The number of passes was limited to three, as in the former tests, this being considered the maximum allowable from the standpoint of production. However, it was found necessary to exceed two passes in only five cases.

With the set-up as described above, the action of the vibrators was sufficient to transmit the effect through the concrete to the subgrade, as was attested by the fact that the vibrations could be distinctly felt by a person standing on the ground outside the line of forms.

SERIES B—TESTS TO DETERMINE EFFECT OF DELAYED FINISHING

In series B, a method of finishing concrete pavement slabs proposed by T. H. Johnson, of Sioux City, Iowa, and known as the "Johnson method," was investigated.[2] In all, 40 sections were constructed, 16 with gravel as coarse aggregate, 16 with crushed stone as coarse aggregate, and 8 in which the total aggregate was a sand-gravel mixture approximating in grading the so-called "Platte River gravel" used extensively in Nebraska and western Iowa. The gravel and crushed stone sections were further subdivided as to fine aggregate, an equal number of sections in each group being constructed with coarse and fine sand.

Methods of Finishing (Series B)

The procedure used in finishing the concrete by the Johnson method was as follows:

Immediately after the concrete was deposited on the subgrade it was struck off with a hand screed. It was then floated with a long-handled wooden float 12 in. wide by 20 in. long by 2¼ in. thick. The thickness was obtained through the use of a 1¾-in. cypress plank with a ½-in. oak plank nailed to the bottom, the oak making contact with the concrete. After floating, the surface was rolled with a light-weight sheet-metal roller. The roller was operated from side to side of the pavement and was advanced about one foot longitudinally with each passage. The entire surface was rolled three times, after which it was belted.

This was followed by the application of the so-called "dry mix" to the surface. This mixture was made up of

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From paper by F. H. Jackson and W. F. Kellermann, presented to 36th annual meeting of the American Society for Testing Materials, June 30, 1933.

[1]F. H. Jackson, "Studies of Paving Concrete," *Proceedings*, Am. Soc. Testing Mat., Vol. 31, Part II, p. 457 (1931).

[2]A detailed discussion of this method was presented by T. H. Johnson at the Twenty-third Annual Meeting of the American Concrete Institute in 1927 (see *Proceedings*, Am. Concrete Inst., Vol. 23, p. 458).

one part cement to one part of fine sand by volume, and was spread over the surface with shovels at a rate of one sack of cement per 20 sq. yd. of pavement. For a 7-in. pavement this would be equivalent to increasing the total amount of cement used about 0.25 bag per cu. yd. of concrete. Just enough of the mixture was applied to give a very thin continuous cover. The sand used for this purpose was the same as the fine sand used in the concrete mixture and contained approximately 5 per cent of moisture when mixed with the cement. After an interval of 11 to 50 min., depending upon the amount of water brought to the surface by the dry mix, the surface was again belted. This was followed by floating with hand floats at intervals until there was little moisture brought to the surface and the concrete became sticky and was drawn along by the float. This general procedure was sometimes varied by belting between floating operations and by additional rollings. The number of floatings necessary to bring the surface to the required condition after the dry mix was applied varied from three to seven, and the elapsed time from the placing of the concrete to the final floating varied from 2¼ to 3¾ hr.

FACTS DEVELOPED

The major facts developed by this investigation may be summarized as follows:

Series A—Effect of Vibration

1. When finished by the standard method, without vibration, the minimum slump required to insure pavement slabs substantially free from honeycomb was found to be approximately 2½ in.

2. When finished by vibration, the minimum slump required to insure the same degree of uniformity was found to be approximately 1 in. In all cases the highest slab strength as well as the least honeycomb is found in the vibrated group containing one-fourth part additional coarse aggregate.

3. The average flexural strength of all vibrated pavement slabs in which the concrete showed an average slump of 1 in. was somewhat higher than the average strength of the standard-finished concrete of the same proportions in which the average slump was 2 in.

4. The average flexural strength of all vibrated pavement slabs constructed of concrete having the same proportions of cement, fine aggregate and water but containing one-fourth part more coarse aggregate, by volume, than the standard-finished concrete, was considerably higher than the standard-finished concrete.

5. The increase noted under (4) was most marked in the case of the crushed-stone concrete and least in the case of the gravel concrete.

6. The average flexural strength of all vibrated concrete slabs containing one-half part more coarse aggregate than the standard-finished concrete was somewhat higher than the standard-finished concrete.

7. The process of finishing by vibration did not adversely affect the hardness of the surface.

Series B—Effect of Delayed Finishing (Johnson Method)

1. Pavement slabs finished by the Johnson method showed higher crushing and flexural strengths than standard-finished concrete of the same proportion but containing less water. This observation applies to both of the proportions studied.

2. Pavement slabs finished by the Johnson method developed substantially the same crushing and flexural strengths as standard-finished slabs containing one-half part less fine aggregate and one part less coarse aggregate. The Johnson-finished slabs, after correcting for the amount of cement in the "dry mix," contained approximately one sack of cement less per cubic yard of concrete than the standard-finished slabs.

3. Although, for each proportion, the water-cement ratio at the time of mixing was lower in the case of the standard-finished concrete, the final density of the concrete as revealed by tests on the cores was higher in the case of the Johnson-finished slabs.

4. Variations in crushing and flexural strength due to changes in proportions and methods of finishing were more marked in the crushed stone concrete than in the gravel concrete.

5. The process of finishing by the Johnson method did not adversely affect the hardness of the concrete.

6. The process of finishing by the Johnson method resulted in decreasing the voids-cement ratio approximately 0.1 more than the corresponding decrease shown for the standard-finish concrete.

Cost-Reducing Equipment to Be Used in Paving Demonstration

The city of Manitowoc, Wis., has voted to accept an offer by the Manitowoc Shipbuilding Corp. and the Medusa Portland Cement Co. to lay a test pavement on one of the city's streets.

Codes of Fair Competition in Preparation

Many codes of fair competition are in course of preparation by groups and committees representing various industries related to concrete construction. Space will permit only a synopsis of what has been accomplished to date.

Cement Manufacturing Industry. The cement manufacturing industry as a whole is working with all possible speed on its code; but without waiting for the code to be completed the entire industry has established a preliminary minimum hourly wage of 40 cents, and a 36-hour work week, effective August 1. The letter announcing this plan, addressed to President Roosevelt by Charles F. Conn, president of the Cement Institute, was given nationwide newspaper publicity on July 14.

Concrete Aggregates. The National Sand and Gravel Association, the National Crushed Stone Association, acting jointly, are developing a single code to cover the three groups. Printed copies of the preliminary draft were discussed at length during large meetings of the three groups held in Chicago on July 12 and 13, and in a joint meeting on July 14. Some details remain to be ironed out before the code is ready to be submitted, but the spirit of the largely attended meetings was favorable to swift action.

Reinforcing Steel. The basic code for steel mills was prepared by the American Iron and Steel Institute and submitted on July 17. Representing its own branch of the steel industry, the executive committee of the Concrete Reinforcing Steel Institute met in Chicago on July 15, to lay preliminary plans and to draw up the first draft of its code. This draft is to be submitted to members and put into final shape for submission.

General Contracting. An average reduction of 27 per cent in the working hours of construction labor and the establishment of local and regional minimum wages meeting the approval of labor itself are provided in the code for general contractors, submitted to Administrator Hugh S. Johnson on July 11. The code was developed by the National Industrial Control Committee for General Contractors, representing the general contracting business throughout the United States.

Masonry and Concrete Preservation. The Associated Manufacturers of Products for Masonry Preservation and Decoration is the name of an organization being formed by manufacturers of waterproofings, floor hardeners and coatings, and caulking compounds, with the object of preparing a code of fair practice. The first official meeting was scheduled to be held in New York City on August 1. Information may be obtained from R. E. Bishop, A. C. Horn Company, Horn Building, Long Island, N. Y.

Promoting Highway Improvement With the Public

Aggressive Action by State Highway Officials Urged by Edward J. Mehren at A. S. C. E. Meeting—How to Tell the Story

IN an address on "Highway Improvement—How to Keep It Sold to the Public," delivered before the recent annual meeting of the American Society of Civil Engineers, Edward J. Mehren, president of the Portland Cement Association, outlined the methods through which state highway departments may carry their story to the highway-using public.

How to Tell the Story

After setting forth the problem and discussing the publicity material which every state highway department has available, Mr. Mehren takes up the question as to how the story can be told.

"An elaborate answer to that question," he said, "will not be necessary. The imaginations of road officials will expand into proper methods a few simple suggestions.

"The newspapers are a very obvious channel. They like to satisfy their readers and readers have an intense interest in highways. Supplied with live, human interest news from the state highway department, they will eagerly print the material.

"Another obvious outlet is through addresses to chambers of commerce, Rotary, Kiwanis and other service clubs. They are constantly seeking good speakers and the state highway department which does not train some of its force for effective appearance on the platform is doing itself and the public an injustice.

"Another outlet consists of various highway-user groups. Here let me emphasize that in these groups the state highway department has strong allies ready to assist it in any legitimate enterprises that involve the use and development of the highway system. It is not too much to say that the state highway department which does not organize itself for effective contact with these groups is missing a tremendous opportunity to have itself understood and is neglecting allies of great potential power.

"Some of these groups are:

a. Automobile clubs.
b. Farm organizations.
c. Chain-store associations.
d. Retail dry-goods associations.
e. Automobile and tire dealers.
f. Gasoline and oil interests.
g. Commercial trucking interests.
h. Bus operators.

"These groups are in a receptive frame of mind. Their success is linked with the highway. They want to understand its problems; they want to help. They are tremendous powers if rightly mobilized.

Conclusion

"It is impossible in a brief address to expand this topic fully," Mr. Mehren concluded. "It is hoped, however, that sufficient has been said to show the opportunity afforded the state highway department to put the highway system in a right light before the citizens, who are both stockholders and users. A commercial organization would not fail to seize it. State organizations may feel less impelled to undertake it. But due reflection upon the evil effects of diversion of highway funds in this depression, the consequent interruption of highway work, and the disorganization of highway forces, should convince any straight thinking person that this work can not be neglected without serious detriment to the highway system, to highway transportation and to the public. The expense involved is not great.

"Some few highway departments have attempted to organize this work, but it is safe to say that none has done it adequately or reaped the success that is easily possible."

Copies of the complete address may be obtained from the Portland Cement Association, 33 W. Grand Ave., Chicago.

EDITORIAL

New Types of Cement

P. H. BATES, chairman of Committee C-1 on Cement of the American Society for Testing Materials, in a paper presented to the recent annual meeting of the society, points out the need for several differnt types of special cements to meet the requirements of special service conditions.

After referring to the tendency on the part of some engineers to specify standards deviating from the A. S. T. M. standard for portland cement, Mr. Bates draws the conclusion that the cement-using public is not fully satisfied with the present specifications. He urges the need for recognizing that which is obvious, namely, that the conditions of service require a different cement in a concrete road than in a reinforced concrete building, and a still different one in a massive concrete dam.

Engineers holding positions of responsibility for the success of structures need cements that are able to harden with minimum heat generation, or cements that have the property of low thermal or moisture dilation, or resistance to attack of aggressive waters, or resistance to freezing and thawing, or the ability to develop high early strength, or the property of marked plasticity.

Since it seems out of the question to develop more than one or two of these properties to a major degree in any one cement, Mr. Bates summarizes his recommendations with the assertion that recognized specifications should be prepared for at least six cements. These include high-early-strength cements, plastic cements, those developing low heat of hardening, those having low volume changes, those offering resistance to moisture and aggressive solutions, and at least two of somewhat the nature of present standard portland cements, one being lower in lime and higher in silica than the other.

Coming, as it does, from a high authority on cement, this recommendation may presage the development of a much clearer understanding on the part of users of cement, concerning the types needed for special purposes.

Nation-Wide Support for Public Works

A HUGE newspaper advertising campaign has been inaugurated by the Portland Cement Association as an effective means of supporting the federal public works construction program.

The economic value of concrete roads, the need for more grade separation structures, the health value of sewage disposal plants, are among the features emphasized in the advertisements.

Giving work to home labor, creating business for home industries, and improving the health of the home community, are the advantages suggested by text and illustration.

Concrete construction interests of states and of smaller communities would find it profitable to tie in with the association's campaign, because of the value of these advertisements in building up a background of favorable public sentiment.

The advertisements alone tell a convincing story; but local civic and construction organizations can add to the force of the association's publicity campaign by means of supplementary activities. Various ways in which this may be accomplished will be suggested by a study of the advertisements themselves.

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600 Millions in Gasoline Tax

A GASOLINE tax of 600 million dollars is what the motorists and motor truck owners of the United States paid into the tax coffers of the national, state and local governments in 1932, according to an article by Philip Hampson in the Chicago Tribune.

Legislative bodies have traveled a long road toward intolerable abuse of the taxing privilege since the first gasoline tax, amounting to one cent a gallon, was imposed by the legislature of Oregon in February, 1919. That tax produced a little more than a million dollars the first year, and the entire amount collected was spent on road construction.

Now the taxes on gasoline range all the way from 3 to 12 cents a gallon, the average being 5.15 cents, and the sums collected are being spent for all manner of purposes. On April 1 of this year the average retail price for gasoline in 50 cities was 10.92 cents a gallon, exclusive of the tax. That means a sales tax of 47 per cent! It means also that the average motorist, who uses about 600 gallons of gasoline in a year, pays a gasoline tax ranging anywhere from $18 to $72 a year, in addition to the tribute exacted for state and city license plates.

The Illinois court decision and the decision of the attorney general of Minnesota, mentioned editorially in previous issues of Concrete," will undoubtedly act as checks to further diversion of gasoline taxes.

Other court decisions aimed at the exorbitant amount of the tax in some states and cities are sorely needed. A few victories in that direction will aid in bringing the levy back to 2 or 3 cents a gallon—an amount which motorists will gladly pay if the funds so raised are spent on road construction and maintenance.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Vibrating and Delayed Finishing Improve Pavement Concrete

A 44-PAGE paper presented to the recent annual meeting of the American Society for Testing Materials, by F. H. Jackson and W. F. Kellermann, reports the results of a series of tests conducted by the U. S. Bureau of Public Roads on a number of full-size concrete pavement sections, placed and finished under actual working conditions. The general procedure was similar to that outlined in connection with earlier tests reported in the 1931 *Proceedings* of the A. S. T. M., Part II, page 457.

The earlier tests proved quite conclusively that pavement concrete having a slump of less than 2 in. could not be placed satisfactorily by the finishing methods then in use. The present paper reports the results of tests to determine the effect of vibrating the concrete during the finishing operation. Study was made also of the effect of delayed finishing, by a procedure known as the "Johnson method," for the purpose of removing excess water.

In general, the recent tests indicate that by using high-frequency vibratory equipment of the type employed it should be possible to place and finish drier concrete, as well as concrete containing considerably more coarse aggregate, than by ordinary methods.

The tests also indicate that the use of the "Johnson method" of finishing will increase the density and the strength of the concrete pavement slabs. This process eliminates a larger quantity of excess water before final consolidation than is accomplished by the usual methods of finishing.

The Jackson and Kellermann paper was published in separate pamphlet form as 1933 Preprint No. 51, under the title of "Further Studies of Paving Concrete." The final paper, together with discussions, will appear in the 1933 *Proceedings* of the A. S. T. M.

A. S. T. M. Specifications for Ready-Mixed Concrete

THE Tentative Specifications for Ready-Mixed Concrete, prepared by Committee C-9 of the American Society for Testing Materials, is available in limited quantities in separate pamphlet form.

Persons interested in this specification should request copies from the secretary of the A. S. T. M., 1315 Spruce St., Philadelphia, Penna. Criticisms and suggestions for the improvement of the specifications should be addressed to R. R. Litehiser, secretary of Committee C-9, Ohio State Highway Department, Columbus, Ohio.

Light-Weight Aggregates Specifications

COMMITTEE C-9 of the American Society for Testing Materials, at the annual meeting of the society in Chicago, presented its proposed Tentative Specifications for Light-Weight Aggregates as a part of its printed report designated as 1933 Preprint No. 39.

Copies of the preprint are available in limited number, and any one desiring a copy should address his request to the secretary of the A. S. T. M., 1315 Spruce St., Philadelphia, Penna. Criticisms of the specification should be addressed to R. R. Litehiser, secretary of Committee C-9, Ohio State Highway Department, Columbus, Ohio.

Standardizing Absorption Tests

THE 1933 report of Committee C-9 on Concrete and Concrete Aggregates, of the American Society for Testing Materials, contains two proposed tentative specifications pertaining to absorption by concrete aggregates. The printed report was presented at the annual meeting of the society, held in Chicago in June.

The first of the proposed standards is the Tentative Method of Test for Absorption by Aggregates (Laboratory Determinations). The second is the Tentative Method of Field Test for Absorption of Mixing Water by Aggregates. Persons desiring copies of these two specifications should send their request to the secretary of the A. S. T. M., 1315 Spruce St., Philadelphia, Penna. Copies are available, however, only in limited number.

Criticisms of the proposed specifications should be addressed to R. R. Litehiser, secretary of Committee C-9, Ohio State Highway Department, Columbus, Ohio.

Urges Various Types of Cement

IN a paper entitled "Status of Specifications for Hydraulic Cements in the United States," presented at the 1933 annual meeting of the American Society for Testing Materials, P. H. Bates urges the preparation of recognized specifications for special cements to meet special service conditions.

The properties of the various needed types are then presented, with a discussion of their adaptability to various services. A particular example is made of the conditions that had to be met in the construction of Boulder Canyon Dam, and the nature of the cement developed for use in that structure.

The paper was published as a separate pamphlet, designated as 1933 Preprint No. 43. It will doubtless appear, with discussions, in the 1933 *Proceedings* of the A. S. T. M.

Specifications for Precast Slabs

THE first draft of a Standard Specification for Light Precast Concrete Slabs has been issued for consideration, by the British Standards Institution, 28 Victoria Street, S. W. 1, London, England. The proposed specification covers precast partition units in particular, and requirements are given for several types of light-weight aggregate, such as crushed cinders, coke breeze, natural volcanic rock, and water-cooled blast-furnace slag.

Tables of required compressive strengths are included, and tests are specified for the determination of properties such as strength, moisture absorption, weight, drying shrinkage and loss on ignition.

Concrete Siphons and Canal Linings Feature Irrigation System

By G. W. HITCHCOCK
Spokane, Wash.

OTIS ORCHARDS irrigation district, a tract of 2,726 acres in the Spokane valley, in the state of Washington, originally obtained its water supply from Newman Lake.

Contrary to estimates, the supply proved inadequate. The level of the lake was gradually lowered until, in 1929, it became necessary to pump water up into the main canal of the system during virtually the entire year.

An engineering survey resulted in the decision to bring a new supply of water from the Spokane River to supply 2,453 acres of land with 40 in. of water per season. The remaining 273 acres, lying at a higher level, will continue to be irrigated by Newman Lake.

The new supply of water is brought from the Spokane River through a canal and flume 3½ miles long, built at a cost of $90,000, including the cost of laterals, siphons and incidental construction.

How Construction Was Speeded

Since speed was an all-important element in the construction of this system, because of the urgent need of a new source of water, the contractor, employing about 125 men, started work from both ends. Intelligent co-operation between the contractor and the engineers in charge resulted in the greatest possible rate of progress.

A 1½-yd. dragline went ahead digging the canal. The same dragline, rigged as a pull shovel, was used on trench excavation for laterals. The shovel was followed by the subgrade finishing crew. Next came the concrete canal-lining crews. One crew worked on concrete structures, another excavated for pedestals, and another placed the concrete in the pedestals. Three timber crews followed to erect the flume substructure, 35 ft. high in places. These were followed up by three crews erecting the 10,000 lin. ft. of creosoted wood stave and semi-circular flume. All of the trestle was set on concrete pedestals. The final survey, cross-sectioning, staking out of the works, and actual construction work all started simultaneously. Everything moved so smoothly that the contract was completed ahead of time and the fruit trees were saved. The completed cost, notwithstanding the "rush work," was done within the estimate.

Long Siphon Is Feature

One of the heaviest parts of the work was the construction of an intake siphon near the intake, 218 ft. long, of reinforced concrete. It passes under two roads and a railway track at East Farms and connects with the measuring box at the northwestern boundary of the district. This also is of concrete. Another siphon takes the ditch under a highway and two lateral ditches.

An unusual feature of the job was the immediate lining with concrete of the ditches as soon as dug. This was accomplished by using the contractor's large dragline bucket of about 2 cu. yd. capacity as a tamper. This weight was dropped on the new embankment so as to compact it thoroughly. It proved to be efficient, for no cracks or settlements have occurred.

A record of 750 lin. ft. of concrete-lined ditch was completed in one shift.

The concrete pipe used on the project was manufactured by the Spokane Concrete Pipe Company. The district put in about 3½ to 4 miles of laterals of concrete pipe varying from 10 to 24 in. in diameter. Owing to the amount of pipe used, the stocks on hand were soon exhausted and the pipe had to be made and installed immediately. Due to up-to-date methods of manufacture, this company was able to make the pipe, cure it in steam and deliver it, without causing delay.

Main canal, lined with concrete, and end of siphon passing under another irrigation ditch

Home products were used so far as possible and included 200,000 bd. ft. of lumber, 21 carloads of sand and gravel, 6,500 sacks of cement, and 1,200 tons of concrete pipe.

The system was operating to capacity and supplying its full quota of water, and working smoothly and efficiently, in less than a month and a half after the contract was signed. It is one of the best constructed among the irrigated districts of the state.

Acknowledgments

The contractors on this work were Clifton, Applegate & Toole, of Spokane. C. L. Wickstrom, a consulting engineer of Spokane, surveyed and designed the project and later was appointed as engineer in charge of construction. Walter L. Morgan served as project engineer, and Dan Johnston was field engineer. W. A. Roberts was general superintendent of construction for the contractors.

How Composition of Portland Cement Affects Heat of Hardening

Facts Disclosed in Investigation of Cements for Boulder Canyon Dam—Influence on Rate of Hardening and Strength

A REPORT presented by Raymond E. Davis, R. W. Carlson, G. E. Troxell and J. W. Kelly at the 1933 annual meeting of the American Concrete Institute, and published in the June (1933) *Journal* of the A. C. I., describes the investigations conducted in the engineering materials laboratory of the University of California as a basis for selecting or specifying the cement having the most favorable chemical and physical properties for use in Boulder Canyon Dam.

Factors Influencing Heat of Hardening

Commercial and synthetic cements were employed in the tests. Tentative conclusions, in so far as they pertain to commercial portland cements, show the manner in which chemical composition and fineness of grinding affect not only the quantity of heat generated in the hardening process, but also the rate of hardening and the strength. These tentative conclusions follow:

1. The chemical composition of cement has an important effect upon both the rate and total amount of the heat of hydration during any period.

2. Tricalcium aluminate (C_3A) liberates more heat per unit of weight than does any other major compound, and this liberation very largely occurs during the early stage of the hardening process.

3. Tricalcium silicate (C_3S) is next in importance from the standpoint of heat liberated during the hydration process. Its heat is liberated principally during what may be called the "secondary" stage of hardening, which under normal curing conditions will be within the first week or even within the first day after hardening begins.

4. The compounds producing the least heat of hydration are dicalcium silicate (C_2S) and tetracalcium alumino-ferrite (C_4AF). The evidence is that the heat of hydration generated by these compounds is slow and long-continued.

5. Other things being equal, the finer a cement, the greater the heat of hydration.

6. Increasing the water-cement ratio increases the heat of hydration, but the percentage of increase in heat of hydration is approximately one-fifth of the percentage of increase in water-cement ratio.

7. For the same water-cement ratio *and the same curing temperatures*, the heat of hydration of a given quantity of a cement is practically independent of the richness of mix, being essentially the same in a neat-cement paste as in a corresponding concrete.

8. The strength of concrete under both normal and mass curing conditions is affected greatly by the chemical composition of the cement.

9. Tricalcium silicate (C_3S) is principally responsible for the early strength of cement mortars and concretes. The indications are that most of its contribution to the strength occurs within the first week of the hardening period.

10. Dicalcium silicate (C_2S) contributes very little to the early strength of cement mortars and concretes, but is responsible for most of the gain in strength after the first week. It provides a long-continued increase in strength so long as water is available for hydration.

11. Under conditions of mass curing, for those cements which are high in tricalcium silicate, there is little gain in strength after 28 days; but for cements which are high in dicalcium silicate, there is a large gain in strength after 28 days.

12. The dicalcium and tricalcium silicates, weight for weight, apparently contribute about equally to the ultimate strength.

13. Other things remaining equal, the greater the C_3A content and the less the C_4AF content, the greater the strength at the early ages but the less the strength at the later ages.

14. The effect of an increase in fineness is to increase the strength very materially, not only at the early ages but also at the later ages. The strength is increased nearly in proportion to the increase in the specific surface. This is in contrast to the effect of increase in fineness upon heat of hydration, which is relatively small.

15. Continuous mass curing results in higher strength at early ages than does curing at normal temperature. At later ages, mass curing results in higher strength than normal-temperature curing only for cements of high dicalcium silicate (C_2S) content.

16. For cements which are high in dicalcium silicate, the 7- and 28-day compressive strengths of mortars cured under normal conditions at 70 deg. F. do not give a true indication of the strength of these mortars when cured under mass conditions.

17. Within the usual range of fineness of commercial cements, the finer the cement the less the water requirement to produce a concrete of fixed consistency.

18. The specific surface, as determined through the use of the micrometer apparatus, is considered to be the most satisfactory measure of cement fineness. The percentage passing the 200-mesh sieve is not a satisfactory measure of fineness, but the percentage finer than 20 microns (determined by the air analyzer) is proportional, within fairly consistent limits, to the specific surface as determined by the micrometer.

A. S. A. Absorbs Some Functions of Bureau of Standards

At a press conference in the office of Secretary of Commerce Roper, on July 19, announcement was made of the transfer of certain functions of the National Bureau of

Standards to the American Standards Association. The latter is a federation of 37 national technical societies, trade associations, and governmental bodies. Following are the specific activities transferred:

(1) Division of trade standards.
(2) Division of specifications.
(3) Division of simplified practice.
(4) Building code and plumbing code sections of the building and housing division.
(5) Safety code section.

The office of the American Standards Association is at 29 West Thirty-ninth St., New York.

Bloomington's Sewage Disposal Plant Wins Heated Campaign

First Self-Liquidating R. F. C. Project of This Type in State—To Repay $428,000 Loan with Service Charge—Other Cities Follow

"REGARDLESS of a thousand different opinions from a thousand different economists, the only real difference between good times and bad is that in good times the people are buying, buying, and in bad times they're not." It was with those words that a leading newspaper in Bloomington, Ind., closed its argument in behalf of a new self-liquidating sewage disposal plant for Indiana's attractive university town.

Service Charge to Repay Loan

The R. F. C. had approved a loan of $428,000 on a like amount of revenue bonds secured by service charges on the sewer users; the mayor had arranged to submit the proposition to popular vote in accordance with an earlier promise; city officials had laid all the cards on the table, giving a detailed explanation of the benefits to be derived from the construction of needed and useful public works; the State Board of Health had made a survey and issued a report insisting that the city replace its inadequate and dangerous sewerage system with a modern, comprehensive system—and still a coterie of citizens contended vociferously that economy in 1933 was more important than all other considerations.

One well-meaning, if misguided, citizen went so far as to send a flaming letter to the newspapers beginning "Crucify the renters of Bloomington! Cut the poor man's throat from ear to ear. Violate his daughter and lash the bare back of his wife with a cat o' nine tails," calling the proposed improvement "a most diabolical scheme to take advantage of those who do not own any property." One voluntary contributor to the anti-improvement campaign was frank enough to write an article saying that he preferred charity to work on a sewer project, or any other project requiring manual labor.

Need of Improvement Unquestioned

But the mayor—working tirelessly in behalf of the success of the project—answered such "explosions" with the calm assertion that, so long as the public interested itself enough to turn out a representative vote and an intelligent one, he would be satisfied. Over and above the city's unquestioned need of the improvement, he stressed unemployment relief through work rather than charity—and on that issue the election carried better than 3 to 2.

Mayor Campbell described the outcome as a case of "saving Bloomington from sewercide," inasmuch as several suits had previously been filed against the city's old plant.

Work for 600 Men

The new project—on which work was expected to begin about July 1—is essentially an unemployment relief measure and as such will be watched with interest by other cities throughout the state and nation. Relief labor is to be used throughout and jobs for at least 600 men for six months are expected to result from the improvement. Production and transportation of the materials involved will provide additional employment through dealers, manufacturers, and producers.

Project Carefully Planned

In forming a comprehensive plan for present and future sewers, the engineers gave careful consideration to the areas which are likely to develop within the next 40 to 50 years. The improvement will include a sewage treatment plant; outfall sewer extensions; outfall relief sewers; and a main outfall sewer, a pumping station and a force main for the north side.

The treatment plant will consist essentially of mechanically cleaned preliminary settling tanks with separate sludge digestion, followed by trickling filters of the fixed spray nozzle type with secondary settling. It is to treat an average dry weather flow of 3,750,000 gallons per day. Approximately 5,000 cu. yd. of concrete are to be used in the plant construction and in the sewer pipe involved.

Bloomington was the first city in Indiana to exercise its borrowing power under the state's enabling acts governing self-supporting improvements. Other Indiana cities which have followed suit in securing R. F. C. assistance to proceed with similar projects are Michigan City, Union City, and Angola.

Following Bloomington's successful campaign to provide employment while solving a pressing sewerage problem, Governor McNutt's support of a $50,000,000 public works program (including $12,700,000 for sewers and sewage plants that are ready to go now) was announced to 500 public officials and engineers assembled at Indianapolis.

HOW TO DO IT

Questions and Answers
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Steam Curing for Concrete Products

We would appreciate your advising us where to obtain full information on steam curing of precast concrete products, inasmuch as we are preparing to place several special products on the market here.—S. T. L., St. Louis, Missouri.

Several years ago tests were conducted in the plant of the Crume Brick Co., of Dayton, Ohio, on the effect of steam curing of concrete building units. Valuable results were obtained and reported by P. M. Woodworth in several papers published in the Journal of the American Concrete Institute. The February, 1931, issue of CONCRETE, p. 43, contains a summary of the Woodworth reports. The July, 1932, issue of CONCRETE, pp. 19-20, contains an abstract of tests of concrete cured under high-pressure steam, reported by J. C. Pearson and E. M. Brickett in the April (1932) Journal of the A. C. I. A summary of these articles and reports follows:

(1) CONCRETE, July, 1932, pp. 19-20. High-Pressure Steam Accelerates Rate of Hardening.

(2) CONCRETE, February, 1931, p. 43. High-Pressure Steam Curing Produces Full Strength in Two Days.

(3) Journal, American Concrete Institute, February, 1930, pp. 504-512. Paper by P. M. Woodworth, reporting 2-day, 9-day, and 28-day compression tests on concrete building units cured in high-pressure steam.

(4) Journal, American Concrete Institute, June, 1930. Discussion of Woodworth report by W. H. Crume and L. J. Pond.

(5) Journal, American Concrete Institute, October, 1930. Paper by P. M. Woodworth, on results of full year of compression tests on concrete building units cured in high-pressure steam.

Data on Concrete Burial Vaults

I am interested in obtaining data on concrete burial vaults, including specifications, cost of manufacture, market possibilities, distribution channels, and price ranges.—S. H. P., Evanston, Ill.

The questions you have asked are answered, in their order, in the following numbered paragraphs:

(1) Specifications for manufacturing concrete burial vaults may be obtained from the American Concrete Institute, New Center Building, Detroit, Mich., at 10 cents for a single copy.

(2) Cost of manufacture is an extremely variable figure, depending on costs of material and labor and type of equipment used.

(3) Market possibilities are discussed in an interesting article by C. C. Millhouse, in the June (1932) issue of CONCRETE, pp. 21-22. Another article on this subject appears in the June (1933) issue of CONCRETE, page 18.

(4) Concrete burial vaults are sold mainly through cooperative arrangements between the vault manufacturer and leading funeral directors.

(5) The selling cost, like the manufacturing cost, varies greatly, and is likely to range anywhere from $50 to $100 installed. Out of this the vault manufacturer pays a commission to the funeral director, and the former also pays for the cost of installation.

Chemistry of Quick-Setting Cements

I would like to get recent and authoritative data on the technical aspects of quick-setting cement. Can you refer me to a complete treatise on this subject?—T. N. W., New York, N. Y.

A recent book which deals with this subject in considerable detail is "Cement Chemistry in Theory and Practice," by the well known German authority, Dr. Hans Kuhl. Two of the six chapters of this book are devoted exclusively to quick-setting cements, one under the heading of "The Chemistry of High-Strength Cements," and the other headed "The Technical Aspects of High-Strength Cements."

A translation into the English language is available through the Concrete Publishing Company, 400 W. Madison St., Chicago, American distributors for the British publishers, Concrete Publications, Ltd.

Concrete Tanks for Sulphuric Acid

The city of Spokane contemplates building concrete vats for storing sulphuric acid obtained from wood pulp and used to lay the dust of city streets.

What effect, if any, will this acid have on concrete? —S. W., Spokane, Wash.

Sulphuric acid is likely to be harmful to concrete, if the latter is at all porous, and it is customary to line concrete tanks or vats intended for the storage of this acid.

Several manufacturers produce coating materials especially for this purpose. Among the materials employed as protective coatings are acid-resisting asphalts, paraffin wax, mixtures of pitch and tar, and glass plates jointed with acid-resisting cement.

Oil for Coating Concrete Molds

Please send me a list of manufacturers who supply form oil for coating concrete molds of steel and wood. —A. S. V., Lynn, Mass.

The list of manufacturers being forwarded to you can supply oil prepared especially for use in coating concrete molds.

VIBRATED CONCRETE

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BRANFORD MOULD VIBRATOR *(above).*
BRANFORD TABLE VIBRATORS.
BRANFORD VIBRATOR SPADES *(for concrete in building forms).*
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PNEUMATIC VIBRATORS *for Concrete of High Frequency to Suit Any Special Purposes.*

Address Dept. 46

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Through the following actions:

1. Flowability and Workability *in the field,* without additional water, resulting in
   (a) Uniformity (b) Density
   (c) No honeycomb and a minimum possible number of voids due to grading, segregation, harshness, lack of fines, or evaporation of mechanically held water.
2. Void Filling—with an insoluble, permanent, inorganic material; 97½% silica.
3. Increased hydration by retaining for a long enough period of time the initial small amount of water necessary to chemically combine with the cement.
4. Formation of additional cementitious matter by pozzolanic action whereby Barnsdall Admix forms a hydraulic set with the free lime liberated when cement hydrates.
5. Filtering and Adsorptive power whereby it allows any excess water to filter out of the mass, but catches in its ultra-fine pores the fine, active, colloidal cement particles, much of which would otherwise come to the surface and be lost or form laitance.

BARNSDALL TRIPOLI COMPANY
Seneca, Missouri

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POTTSCO used in the largest post office in the country! POTTSCO has exceptional light-weight, compressive strength, great insulating and acoustical value. High in insulation and low in cost! Good for back-up block and partition tile as well as for monolithic work.

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New Books and Pamphlets

Water Towers and Silos

REINFORCED CONCRETE WATER TOWERS, BUNKERS, SILOS AND GANTRIES, by W. S. Gray. Published by Concrete Publications, Ltd., 20 Dartmouth St., London, S. W. 1, England. Cloth binding, 256 pages, 5½ by 8½ in.; 170 illustrations and 2 folders.

This is a companion volume to the author's book, "Reinforced Concrete Reservoirs and Tanks," published in 1931 and reviewed in CONCRETE, January, 1932, page 31. It deals with every problem in the design and construction of reinforced concrete water towers, bunkers, silos and gantries. Helpful information is given on many of the problems which arise in the design of structures of unusual types and which are not dealt with elsewhere, with many labor-saving diagrams for use in the designing office, including a rapid method of drawing influence lines for unequal spans with different moments of inertia.

The treatment of the columns of structures subject to wind pressure is thoroughly discussed. The difficulties of the so-called exact methods are dealt with and approximate practical methods are given covering all the usual cases, including arrangements of columns on concentric circles and polygonal frameworks without diagonals. Worked examples show the application of the methods suggested.

Other problems dealt with are the transmission of heat through concrete walls, the design of tanks to hold hot liquids, and the insulating properties of various materials.

Volume II of Multiple-Span Rigid Frame Design

MEHRSTIELIGE RAHMEN (MULTIPLE-SPAN FRAMES). Volume II, Third Edition, 1933. By Dr. A. Kleinlogel. Published by Wilhelm Ernst & Sohn, Berlin, Germany. Paper cover, 291 pages, 6¾ by 9¾ in. Illustrated with numerous design diagrams. Price 24.50 marks.

Volume I of this work was reviewed in the April (1932) issue of CONCRETE, page 36. The present volume is a continuation of the first volume, and contains twelve additional chapters in which twelve general types of rigid frames are treated. Working formulas are given for each specific type of structure treated.

In general, the types shown in Volume II represent reinforced concrete building frames, while those in Volume I are more definitely applicable to reinforced concrete girder bridges where the girders are monolithic with the supporting piers.

New Booklets on Concrete Floors

The Portland Cement Association, 33 West Grand Avenue, Chicago, has issued two 4-page folders entitled "Concrete Floors for Industrial Buildings" and "Concrete Floors—How to Build Them." Cost, durability, cleanliness, safety, smoothness, solidity, comfort and maintenance are discussed, and correct construction methods fully explained.

A working "Specification for Bonded Concrete Floor Finish" has also been published, and the association's 24-page book "Concrete Floor Finishes," first issued in 1929, has been revised and reprinted. Copies of all publications are available free upon request.

ORGANIZATIONS

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; W. C. Markham, Executive Secretary, 1222-24 National Press Building, Washington, D. C.

AMERICAN CONCRETE INSTITUTE; Harvey Whipple, Secretary, 641 New Center Building, Detroit, Mich.

AMERICAN CONCRETE PIPE ASSOCIATION; M. W. Loving, Secretary, 33 West Grand Ave., Chicago.

AMERICAN ROAD BUILDERS' ASSOCIATION; Chas. Upham, Engineer-Director, National Press Building, Washington, D. C.

AMERICAN SOCIETY OF CIVIL ENGINEERS; Geo. T. Seabury, Secretary, 33 West Thirty-Ninth St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS; C. L. Warwick, Secretary-Treasurer, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

BUILDING OFFICIALS CONFERENCE OF AMERICA; Wm. F. Hurd, Secretary, Room 203, City Hall, Indianapolis, Ind.

CAST STONE INSTITUTE; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

CEMENT INSTITUTE; H. C. Lundborg, General Manager, 11 East 44th St., New York City.

CONCRETE MASONRY ASSOCIATION; Jack Franklin, Secretary, 7071 Plankinton Bldg., Milwaukee, Wis.

CONCRETE REINFORCING STEEL INSTITUTE; R. W. Johnson, Secretary, 333 North Michigan Ave., Chicago, Ill.

ENGINEERING INSTITUTE OF CANADA; 2050 Mansfield St., Montreal, Quebec.

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NATIONAL FIRE PROTECTION ASSOCIATION; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

NATIONAL LIME ASSOCIATION; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

NATIONAL READY-MIXED CONCRETE ASSOCIATION; V. P. Ahearn, Secretary, 545 Munsey Bldg., Washington, D. C.

NATIONAL SAND AND GRAVEL ASSOCIATION; V. P. Ahearn, Executive Secretary, 545 Munsey Bldg., Washington, D. C.

NATIONAL SLAG ASSOCIATION; H. J. Love, Secretary-Treasurer, 1449 Leader Bldg., Cleveland, Ohio.

NATIONAL TERRAZZO AND MOSAIC ASSOCIATION; J. M. Fuhrman, Secretary-Treasurer, 524 Brook Street, Louisville, Ky.

NORTHWEST CONCRETE PRODUCTS ASSOCIATION; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

PORTLAND CEMENT ASSOCIATION; Edward J. Mehren, President; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

RAIL STEEL BAR ASSOCIATION; H. P. Bigler, Engineering Secretary; Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

WIRE REINFORCEMENT INSTITUTE; R. D. Bradbury, Director, National Press Bldg., Washington, D. C.

WISCONSIN CONCRETE PRODUCTS ASSOCIATION; Jack Franklin, Secretary-Treasurer, 425 East Water St., Milwaukee, Wis.

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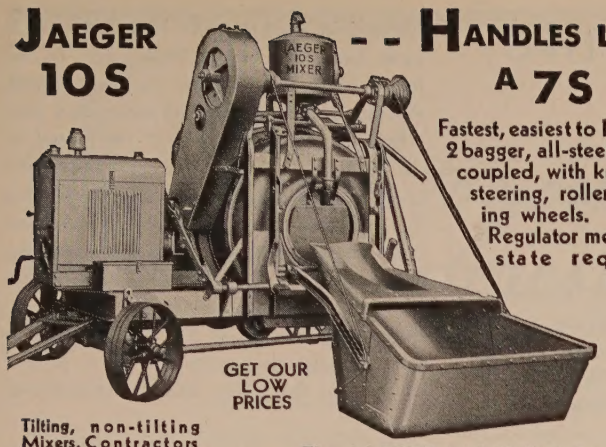

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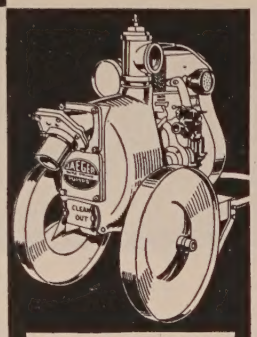

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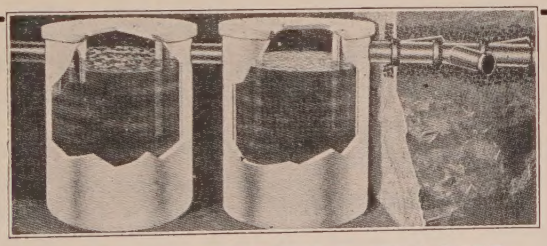

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New national and state public works construction programs mean business for contractors and pipe manufacturers. Sewers and culvert pipe will be used in large quantities for some of the work. Get ready now for the demand.

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A *PROVEN* PRODUCT AND A PLAN THAT MAKES PROFIT! TO BE LICENSED AT ONCE TO RESPONSIBLE CONCERNS . . .

The SURFACE-SEPULCHER — The Modern *Earthless* Grave — is not only *new* and *different;* it is *salable* at a profit! Extensive sales tests have proven it to have most favorable *consumer acceptance.* It is a de luxe item—yet within the reach of the majority. And it lends itself *ideally* to a franchise manufacturing plan for responsible concrete products manufacturers or aggregate producers wishing to establish such an outlet.

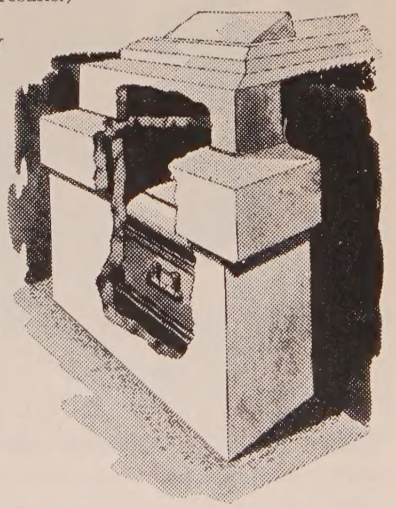
Not Merely Something to Make— Something to Sell!

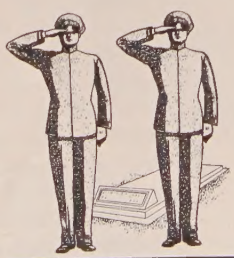
The Surface-Sepulcher is not only something with which to get into production—it is a product that will sell, because it is *now* selling. *To see it is to approve it.* And it is a manufacturing proposition that fits right in with the modern concrete products plant. Requires some skill, but not difficult. Requires some capital, but not a fortune. Requires some pushing, but plans and advertising are already prepared for you. (Note above reproduction of newspaper advertisements that have pulled results.)

CAN YOU QUALIFY FOR THIS FRANCHISE?

There's a heap more to it than we've been able to tell here—more details on this model—other models—your plant facilities—your capital set-up—our 26 years of experience. . . . With this information in mind, are you interested in the further discussion of this franchise?

All replies confidential, and given prompt attention in the sequence in which received. Write or wire . . .





DESIGNED BY

THE NEFF & FRY CO.
Camden, Ohio

Address all inquiries to

EUGENE F. OLSEN CO.
101 Tabor Street, Adrian, Michigan

Exclusive Distributor of Neff & Fry Vault Equipment and Licenses

Surface-Sepulcher a Distinctive New Concrete Product

Vault and Surface Markers Combined in One—Variety of Products and Application of Merchandising Methods Aid Sales

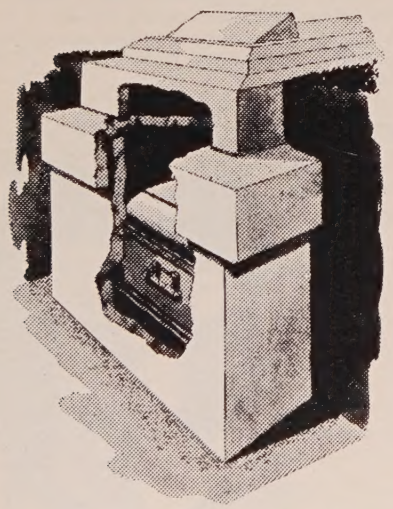
THE Surface Sepulcher, introduced by the Neff & Fry Company, Camden, Ohio, is a new and distinctive concrete product having outstanding possibilities from the standpoint of merchandising as well as manufacturing.

The Surface-Sepulcher is the outgrowth of a thorough study of the concrete vault industry, undertaken some two years ago by Neff & Fry, in co-operation with one of the leaders in the concrete machinery field.

This study was made on a comprehensive nation-wide scale, and it produced many interesting facts. One fact developed was that funeral directors in most cases found it necessary to have different sources of supply for concrete vaults of different design and quality. In a word, concrete vault manufacturers, as a rule, did not produce a line of products that covered the spread required.

The fact remains that in spite of lack in variety of products, and the failure to employ merchandising methods, the manufacture of concrete vaults was the mainstay of many a concern during the years of economic stress.

Neff & Fry have provided the necessary range of products, for in addition to the Surface-Sepulcher they have developed the Sovereign-Sepulcher and the Sectional-Sepulcher, comprising a range of quality products that enable the purchaser to



choose a concrete unit in keeping with the range selected from funeral merchandise.

The Surface-Sepulcher cover unit can be used as a memorial over past burials, thus making another sales possibility, as the part above the ground is of the same design and appearance as the regular Surface-Sepulcher.

From the standpoint of sales, the manufacturer of the Surface-Sepulcher has an opportunity to double his volume, as compared with the sales possibilities for ordinary underground vaults. In the case of underground vaults a sale is possible only where an actual burial occurs. In contrast, the manufacturer of the Surface-Sepulcher has three sales possibilities—first, Sepulchers placed for immediate use; second, those purchased and placed in an entire family lot, for future use; and third, the separate covers previously described and used as memorials over past burials.

All units are manufactured from scientifically mixed concrete, placed in vibrated forms, and well reinforced, all in accordance with the specifications adopted by the American Concrete Institute.

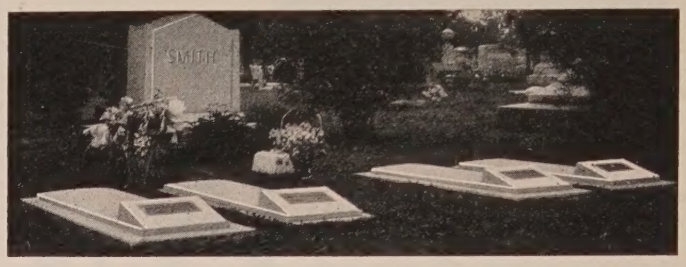
The outstanding characteristic of the Surface-Sepulcher is that it comprises a vault and marker combined in one. The entire part above the ground, including the final cover plate and marker, is essentially a cast stone product, the exposed part being finished in granite chips, ground and polished to a gloss resembling the best quality of polished granite. Yet the design of the cover is such as to make duplication in natural stone practically prohibitive. There is a slightly raised portion at one end for the name of the deceased, and dates of birth and death, thereby eliminating the necessity and cost of a separate monument.

The Surface-Sepulcher is double sealed. The lid to the casket chamber is sealed in cement as it is placed. The cover plate is also sealed with cement. Thus there is no possibility of tampering with the grave, and no water can enter the vault. The air space between the cover plate and the lid of the casket chamber provides an effective air seal, maintaining an even temperature within the chamber.

It can readily be seen that the Surface-Sepulcher has the advantages of the above-ground mausoleum, where no dirt is put back in the grave; and yet it has the individuality of the separate grave.

Prospective manufacturers will be interested in knowing that Neff & Fry, who have had 26 years of experience in the field of concrete vaults, have developed, through actual trial and experience, a merchandising plan which will be placed at the disposal of manufacturers. They have also arranged to assist manufacturers using this equipment by inviting them to send representatives to obtain actual working experience in the Neff & Fry plant. After the equipment has been set up in the purchaser's plant, Neff & Fry offer to send a man to help the purchaser to a proper start with the sales and merchandising plan.

The concrete vault industry, when approached from this angle, is automatically taken out of the side-line class. It becomes an industry of dignity and importance in any community. Prospective manufacturers who are in a position to handle a business of this magnitude should address either Neff & Fry, Camden, Ohio, or the Eugene F. Olsen Co., Adrian, Mich.



Industrial Literature

Truck and Trailer Data

"Truck and Trailer Size and Weight Restrictions" is the title of a handbook compiled by F. M. Higgins, of the research department of the *Four Wheel Drive Auto Co., Clintonville, Wis.* Intended for the use of truck and trailer operators, this little booklet is complete in every detail. The size and weight regulations are condensed in tabular form and can be determined at a glance. All possible truck and trailer combinations are listed in a separate table, giving the total gross loads permissible with each combination.

Swimming Pools

Swimming Pools — Their Design and Construction is a 16-page booklet on the Camco type. Its contents were prepared by an architect and an engineer, with the view of co-operating with architects, engineers and contractors in various localities. These consultants are Eric E. Hall and Wm. H. Eichelman, Chicago.

The booklet answers many questions, its subjects ranging from location, design and construction to illumination, bath house and showers.

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A KNOTT HOTEL

This Economy Double-Headed Nail will save you money on formwork

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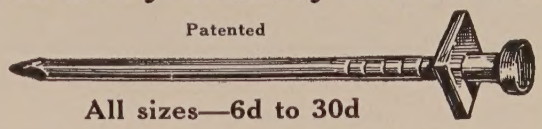

All sizes—6d to 30d

This nail saves *lumber* and *time* on any job of form work. Its large ½" square guard makes it possible to drive it into the wood as hard as you please without danger of sinking the second head. Holds fast but pulls easily. Let us send you half a dozen nails to try out with your own hammer. Just drop a line to—

THE F. A. NEIDER CO., Inc.
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BESSER and ANCHOR

Plain Pallet Strippers pay for themselves in first cost and in operating cost as they make an endless variety of concrete units upon a single set of inexpensive plain Pallets. Now available at any price and capacity desired and with improved features.

Complete sales and service on BESSER, ANCHOR, CONSOLIDATED, IDEAL, HOBBS, UNIVERSAL

Complete equipment for concrete products plants

BESSER MANUFACTURING COMPANY
208 33rd Street Alpena, Michigan

Just think . . . a modern, new hotel, in the heart of New York—200 feet from Broadway, on 45th Street. A room and bath for one, $2.50; for two, $3.50.

It's the PICCADILLY

45th STREET and BROADWAY • NEW YORK
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GIANT EGYPT PORTLAND CEMENT — SPECIFIED

for over 45 years by the leading architects and engineers, and used extensively in some of the largest concrete construction work in the country. That is the record of

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If you haven't found what you are looking for in these advertising pages, drop us a postcard and we will see that you get the information you want. There is no charge for this service.

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400 W. Madison St. Chicago, Ill.

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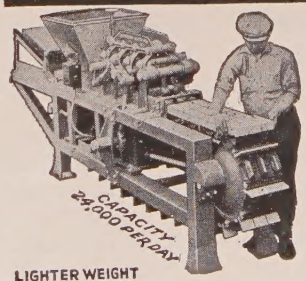
BIG FUTURE FOR CONTRACTORS



LIGHTER WEIGHT STRONGER BOND BIG SAVINGS IN CONSTRUCTION

Manufacturing a proven stable commodity used in the finest and biggest buildings wherever made. Investment only small fraction of that ordinarily required for any other process.

Kalamazoo Haydite Tile Co. sells its output at 100% mark-up. Orders received exceeded a million units in one month.

Bayer & Brice, Flint, Michigan, just received order for over a half million for brewery.

Learn about this wonderful, automatic machine and process. How it brought success to others wherever used. Exclusive franchise. Get the facts. Send for free book "4 Keys to Success for Contractors."

W. E. DUNN MFG. CO.
453 W. 24th St. Holland, Mich.

EQUIPMENT AND MATERIALS

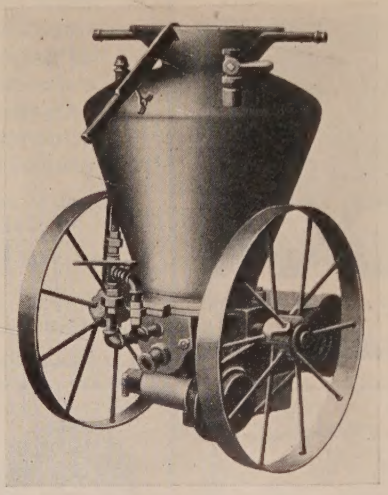
Types and Capacities of Gunitor Models

Extension of processes for pneumatic application of concrete, cement-sand mixtures and refractory substances is made possible through development of new machines for such purposes by the Gunitor Co., Elkhart, Indiana. The new Gunitors were developed under actual operating conditions, and include many improvements.

The line is complete, giving a large selection of apparatus. Among distinctive models are the One-Man Gunitors, operated by electric motors and with electrical remote control. This machine can be charged by one man and started or stopped from remote position.

Other new models are complete units such as the Combine-Gunitor, with gasoline engine, air compressor, water pump and Gunitor, mounted on steel towing chassis with solid rubber tires. Another type includes pug mixer for combining ingredients, and elevating loader for charging hoppers or chambers of the Gunitor. Capacities of material range from 40 cu. ft. per hour in small one-man Gunitors, to 250 cu. ft. per hour in the larger sizes.

Several models are introduced to fill gaps in requirements not otherwise met, it is stated. Weights have been reduced from 25 to 35 per cent to increase mobility and decrease cost of transportation.



Heights are kept down for work in restricted clearances such as tunnels and mines. Charging capacities have at the same time been raised from 30 to 50 per cent, it is said.

Manufacturers' News

Eugene F. Olsen Co. Organized

The Eugene F. Olsen Co. has been organized at Adrian, Mich., for the manufacture and sale of concrete products equipment.

The first item announced is a line of equipment for manufacturing an entirely new type of burial vaults known as Neff & Fry vaults, among which the outstanding item is said to be the Surface-Sepulcher.

•

Pottsco Consulting Engineer

E. A. Randall has been appointed consulting engineer effective July 25 for the *Pottsco Corporation*, Chicago, Ill., and will devote himself to engineering problems in connection with the use of Pottsco lightweight concrete.

Mr. Randall was formerly associated with his brother, Frank Randall, construction and designing engineer of Chicago.

•

To Distribute Rex Equipment

The H. C. Wood Machinery Works, San Francisco, have been appointed as distributors for the construction equipment division of the *Chain Belt Co.*, Milwaukee, Wisconsin. *R. J. Cooper*, who is in charge of construction equipment sales is very well known in the western territory, having worked as a construction engineer and later as a sales representative for several large construction equipment machinery manufacturers on the west coast.

GiantgripT Hand Float Meets Specifications

All state specifications are met by the GiantgripT hand float, according to the L. & M. Manufacturing Co., Cleveland, Ohio.

The steel tube stiffener, extending over the entire length, is fitted with adjusting studs to allow easy alignment of float board and to save constant planing to keep the float straight.

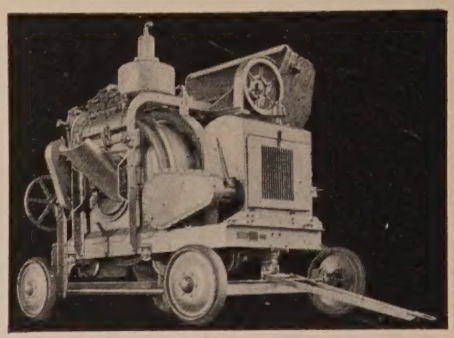
The board is accurately cut from clear, knot-free cypress or fir with edges beveled. The hardwood end cleat is datoed into the board to resist warp. All sizes are available.

Standard handles, with steel forged connector permanently attached, fit all floats and are available in 10, 12, and 17 ft. lengths.

This and other GiantgripT paving tools are included in Catalog No. 5.

Modern Design Feature of New Two-Bagger

The Master 10 mixer is a new two-bagger "ultra modern through and through." Its design is said to be lower, narrower and more compact. It is light, but weight and strength are properly bal-



anced. Portability is assured by roller-bearing wheels, whether steel or rubber tired, full spring mounting, and improved automotive steering.

The Master 10, according to the Construction Machinery Co., Waterloo, Iowa, is easily operated by one man, with all levers within handy reach. Shafts are self-aligning even in the controls, to prevent binding.

•

Milnes Patents New Type Burial Vault

A patent on a new type concrete burial vault, containing two unique features, has been granted to Albert V. Milnes, secretary-treasurer of the Richmond Burial Vault Co., Port Richmond, N. Y., which has the rights of manufacturing these vaults and the forms to make them.